STEM Summit 2012:
Idaho's Roadmap to Innovation and Success

Jan Morrison, President and CEO
Teaching Institute for Excellence in STEM
May 9, 2012

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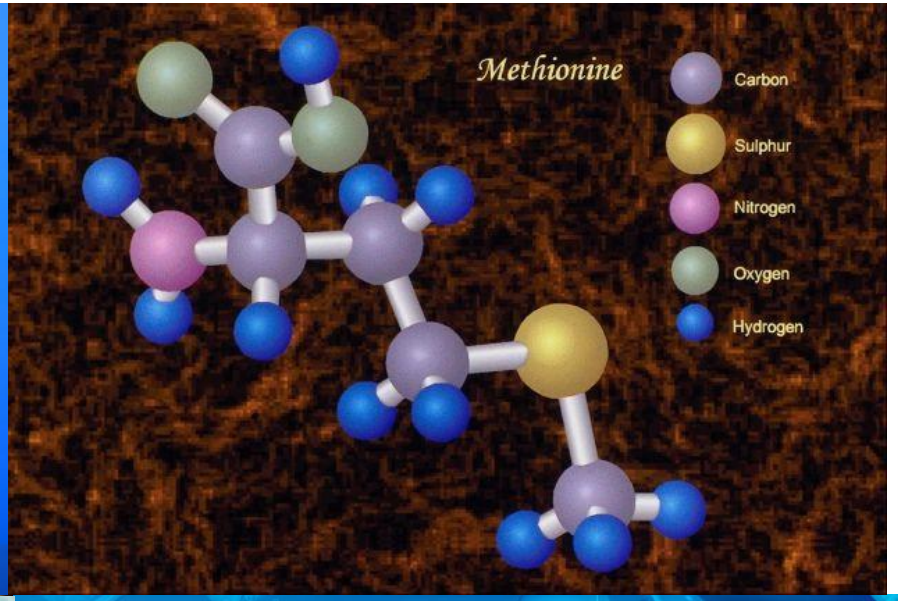
WHAT DO WE WANT TO ENSURE FOR OUR CHILDREN'S FUTURE?

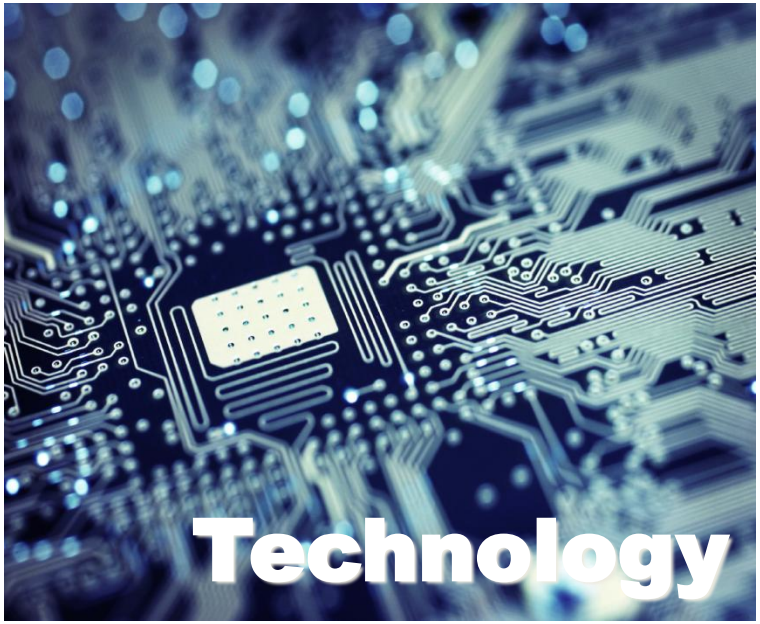
A World that is driven by INNOVATION AND INVENTION to better all of our lives…

Anthony P. Carnevale, Nicole Smith, and Michelle Melton, October 2011. *STEM Science, Technology Engineering, Mathematics – Executive Summary*. Report issued by the Georgetown University Center on Education and the Workforce. http://www9.georgetown.edu/grad/gppi/hpi/cew/pdfs/stem-execsum.pdf

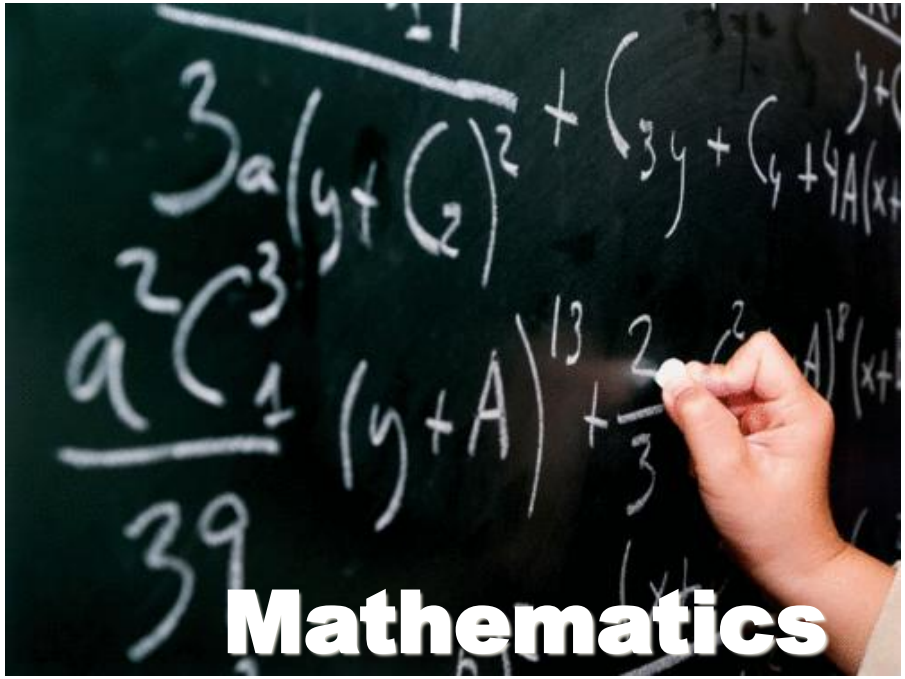

Methionine
Carbon
Sulphur
Nitrogen
Oxygen
Hydrogen

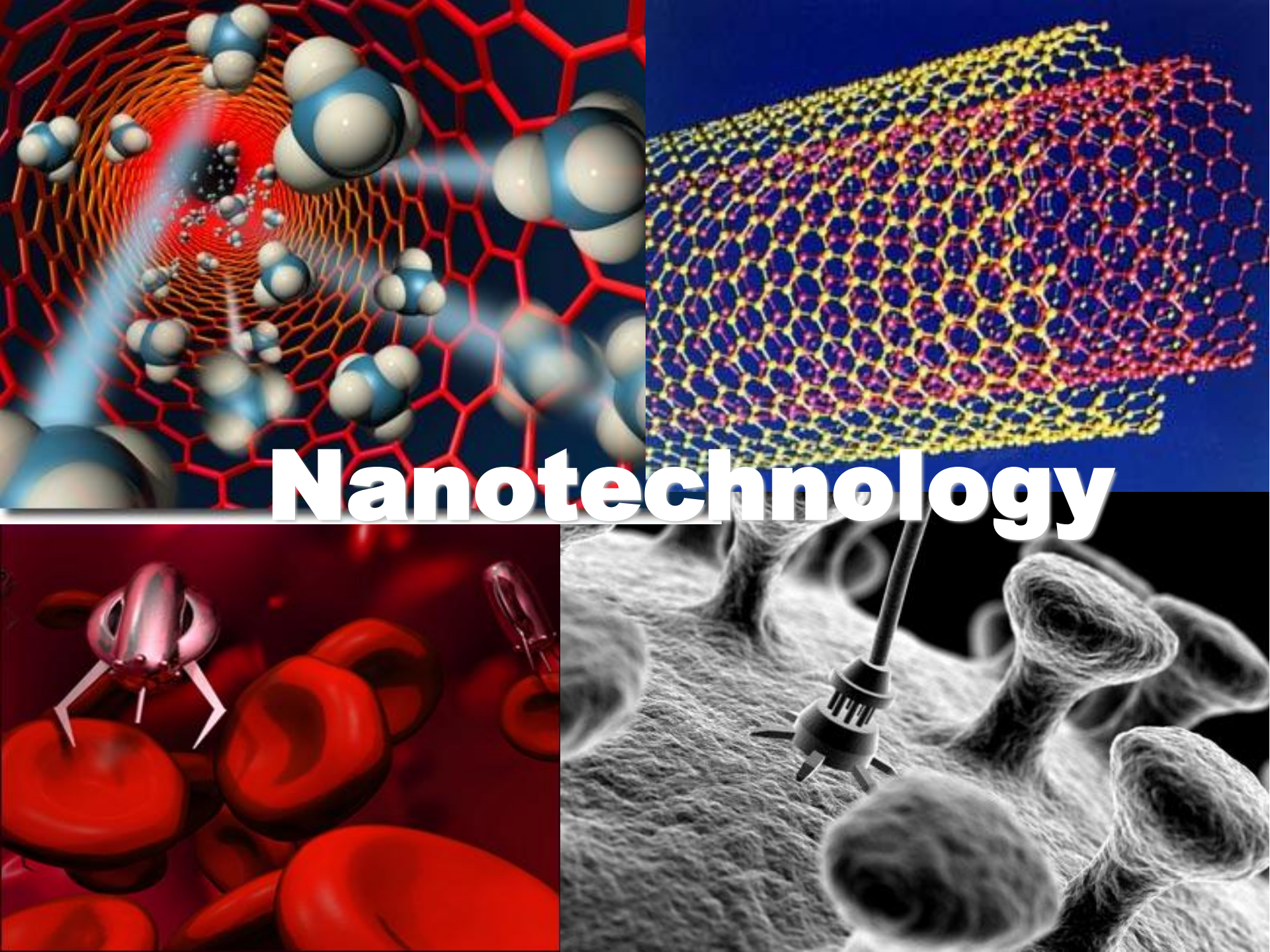

Science & Technology Policy Research and Information Center

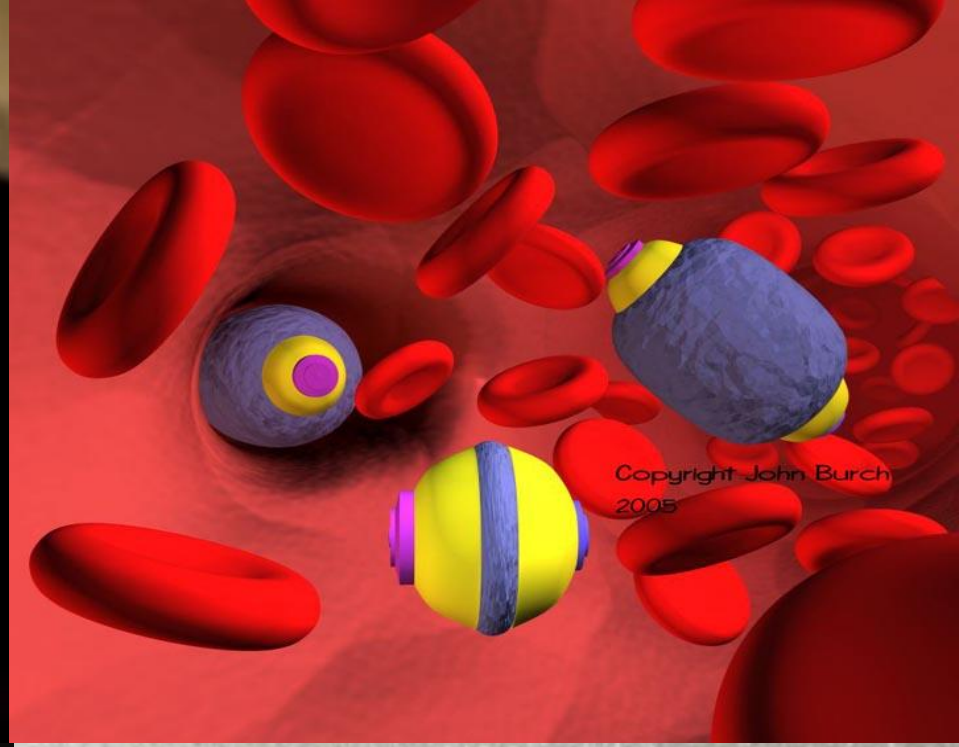

Science


Technology


INDUSTRIAL
POWER SYSTEM PROTECTION
Engineering


Mathematics


Nanotechnology


Copyright John Burch
2005

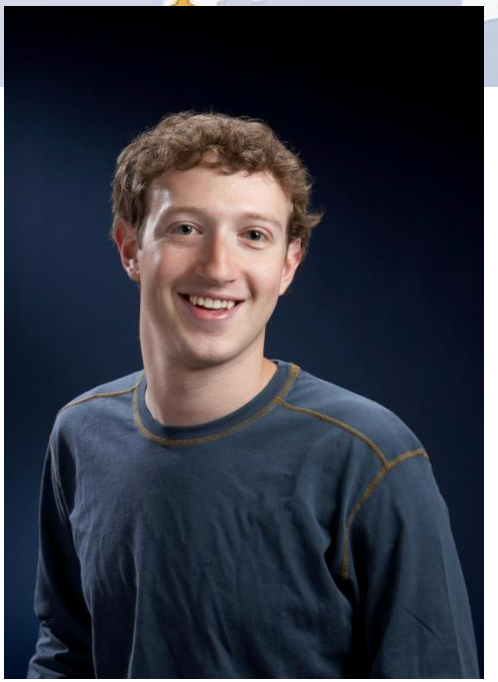
Energy

Communication

twitter

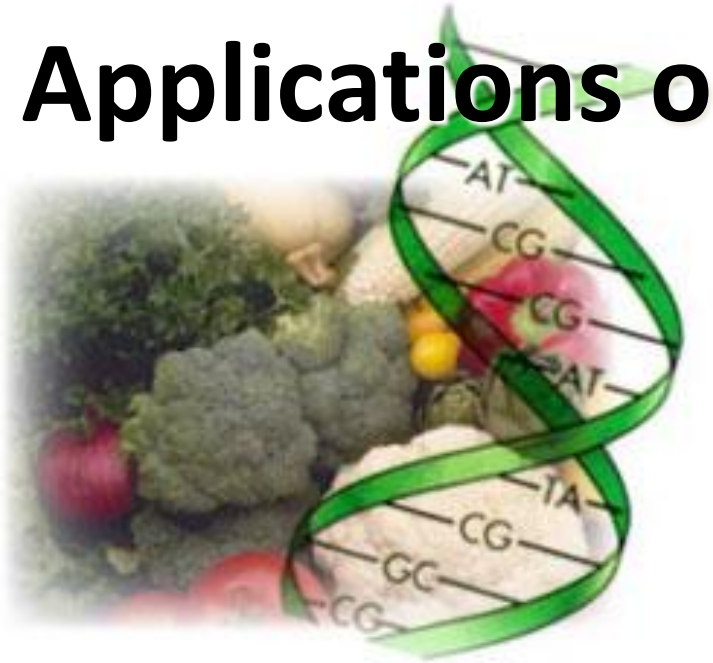
scvngr

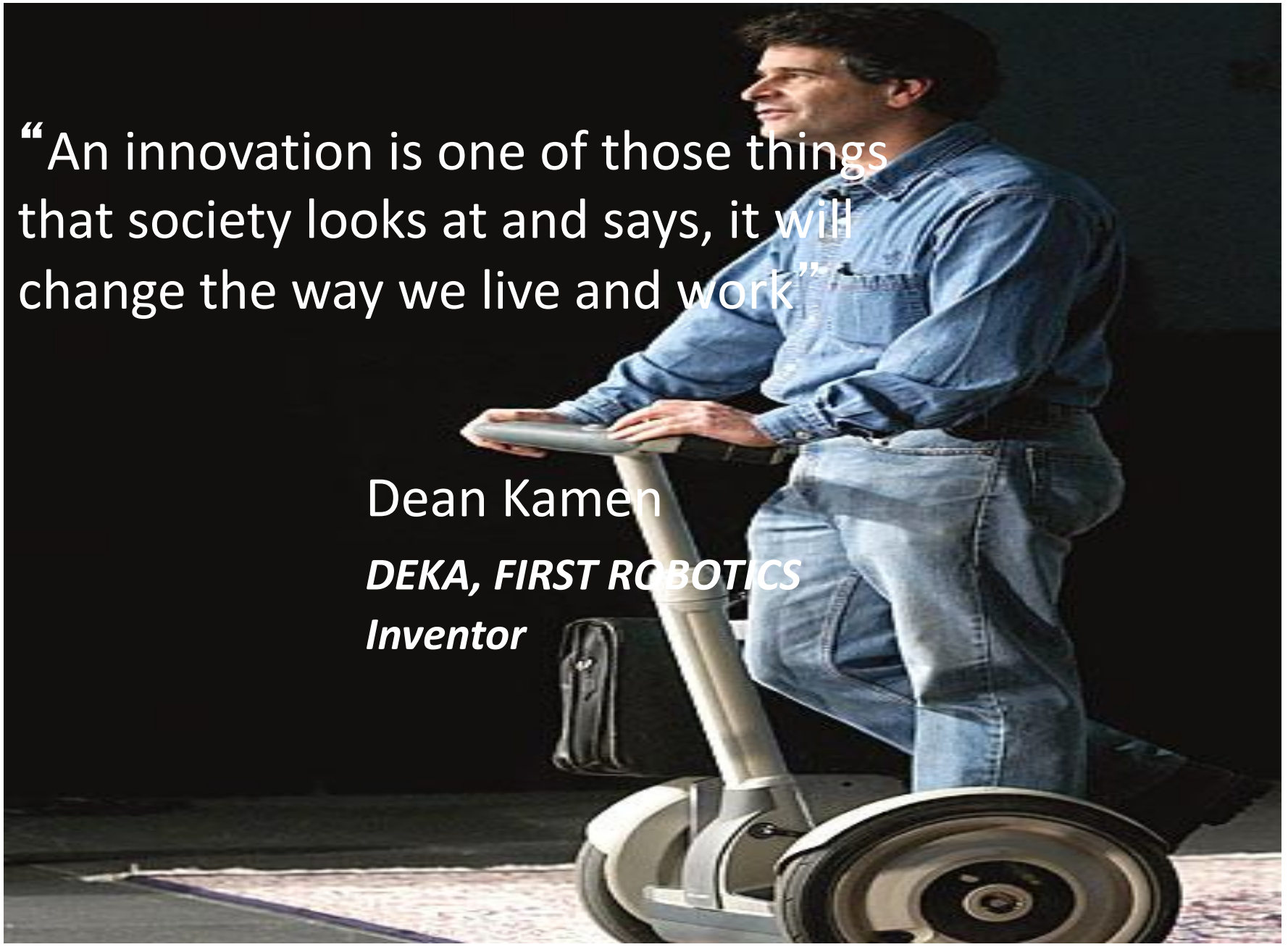
Communication




GENOMICS

Applications of Genomics




“An innovation is one of those things that society looks at and says, it will change the way we live and work”
Dean Kamen
DEKA, FIRST ROBOTICS
Inventor

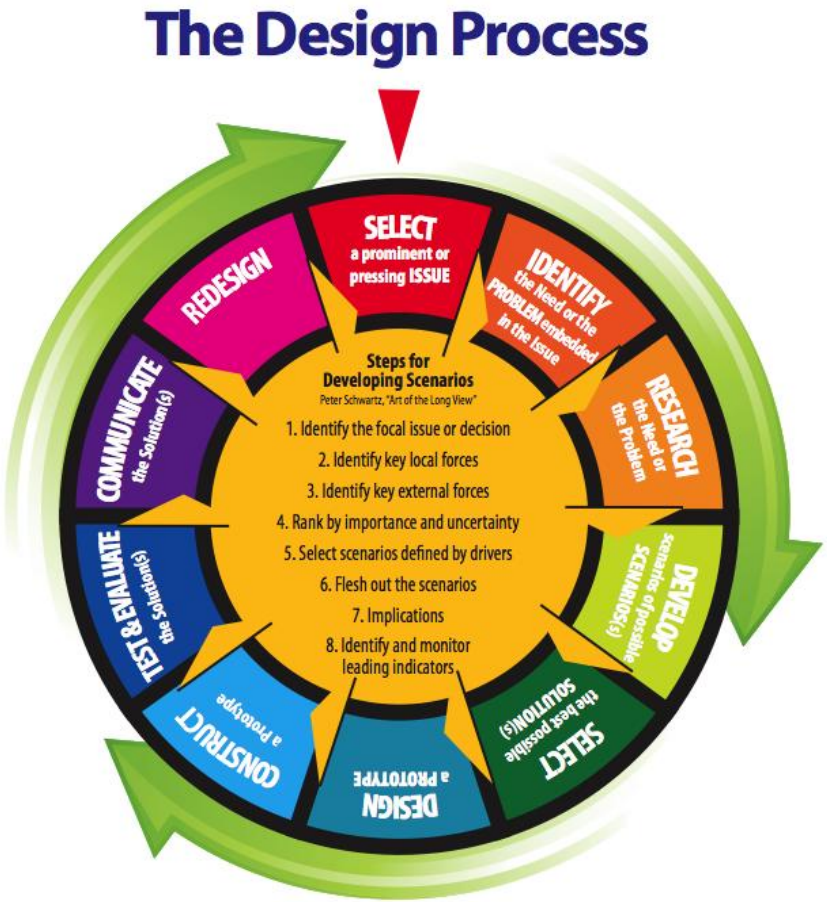
STEM + INNOVATION

= FUTURE

How has America addressed this issue?

Anthony P. Carnevale, Nicole Smith, and Michelle Melton, October 2011. *STEM Science, Technology Engineering, Mathematics – Executive Summary*. Report issued by the Georgetown University Center on Education and the Workforce. http://www9.georgetown.edu/grad/gppi/hpi/cew/pdfs/stem-execsum.pdf

THE HEART OF STEM EDUCATION AND STEM SCHOOL DESIGN…



At its heart the design process is a problem solving strategy. It teaches someone how to think critically and carefully through a problem so that at the end of the process a clear, reasoned, and purposeful solution is reached.

Throughout the STEM School and STEM Instructional Program design process you will be utilizing the design process to develop a reasoned, thoughtful and strategic approach to solving to your state's problems. The product you will conceive, develop, and test will be your plan for sustainable innovation.

What is **STEM EDUCATION?**

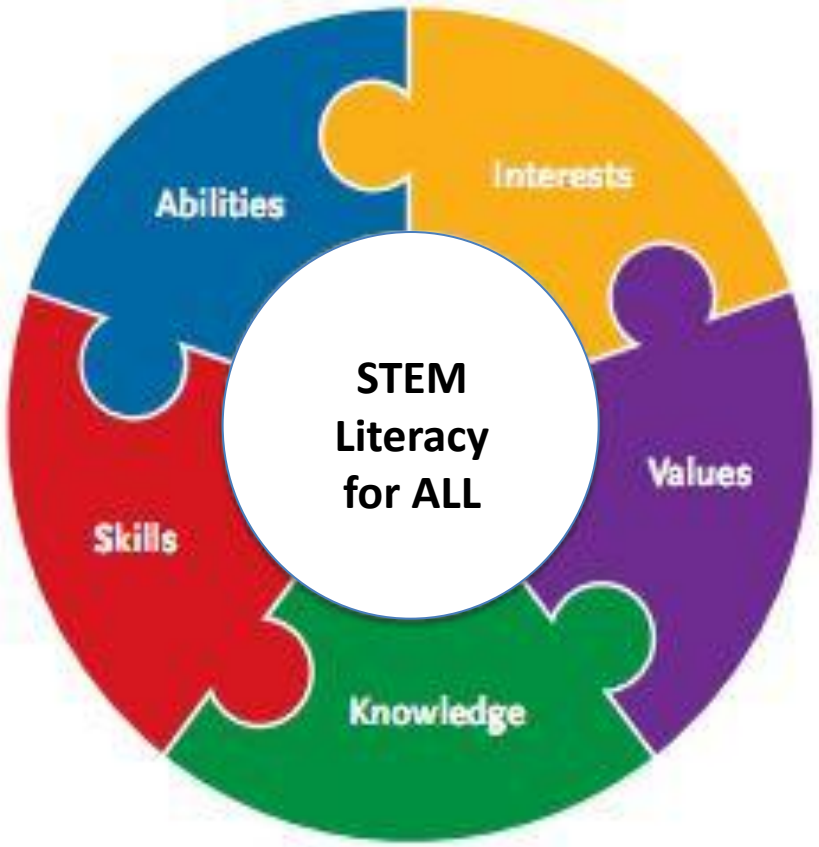
STEM Education refers to the teaching and learning of these disciplines usually in a *trans-disciplinary fashion* to a level of rigor at least sufficient for college readiness without remediation and the **"T & E"** informs the **"S & M"**.

A student's school experience with Science, Technology, Engineering, and Math (STEM) coursework has proven to be an important indicator for overall **college readiness**, **postsecondary success**, and preparation for STEM careers.

But the numbers are cause for concern. Of the 1.9 million students who enrolled in college, only 1.3 million were ready for college-level STEM work **without remediation**, and less than 280,000 intended to major in STEM-related fields.

Anthony P. Carnevale, Nicole Smith, and Michelle Melton, October 2011. *STEM Science, Technology Engineering, Mathematics – Executive Summary*. Report issued by the Georgetown University Center on Education and the Workforce. http://www9.georgetown.edu/grad/gppi/hpi/cew/pdfs/stem-execsum.pdf

Why is STEM IMPORTANT?



Pipeline

- Demand for STEM skills in the labor market
- All jobs require some level of STEM competencies
- Economic competitiveness
- Innovative Workforce

Mainline

- STEM literate citizenry
- Increased rigor on Common Core and NAEP assessments

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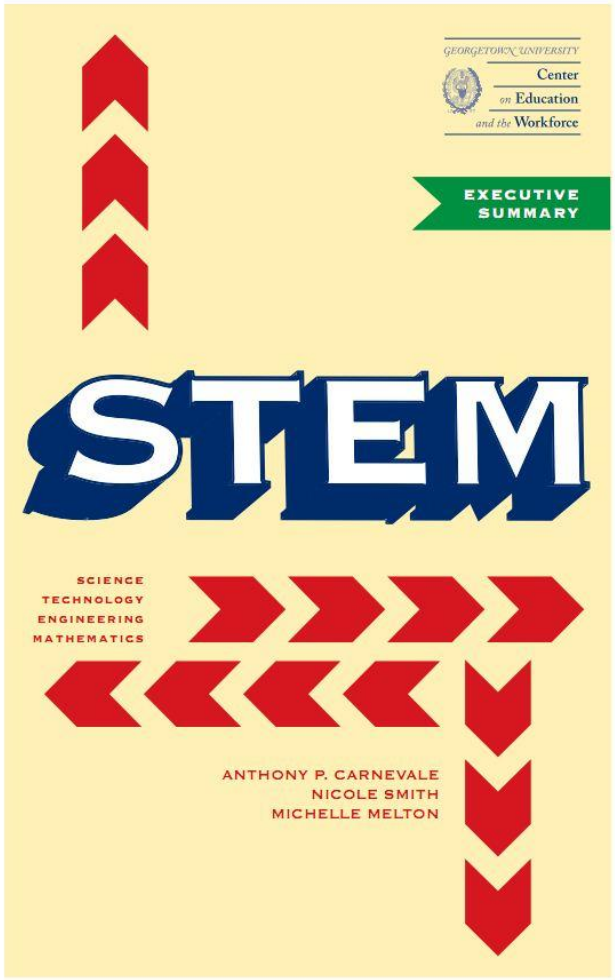
Why is STEM IMPORTANT?



- Traditional STEM jobs have grown faster than job growth overall for decades, and the future promises more of the same.
- The concern for STEM shortages tends to focus on an insufficient supply of STEM workers, but the deeper problem is a **scarcity of workers with core STEM competencies** across the entire economy.
- The vast majority of high paying jobs requires a STEM competent workforce with some form of postsecondary education or training.

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The attributes of a STEM educated student:

Problem-solvers—able to frame problems as puzzles, and to apply understanding and learning to novel situations (argument and evidence)

Innovators—"power to pursue independent and original investigation" (Gilman, 1898) using the design process

Inventors—recognize the needs of the world and creatively design and implement solutions

Self-reliant—able to set own agendas, develop and gain self-confidence, and work within specified time frames

Logical thinkers--using the logic offered by calculus and found in 60% of all professions world-wide; able to make connections to gain an understanding of natural phenomena

Technologically literate--understand the nature of the technology, master the skills needed and apply them appropriately

.

“Pathways to Prosperity”…An American Solution

Three Key Elements…

The first element is the development of a **broader vision of school reform** that incorporates multiple pathways to carry young people from high school to adulthood

The second is the development of a much **expanded role for employers** in supporting these new pathways.

The third is the development of a **new social compact** between society and its young people

…from the Pathways to Prosperity Project, Harvard University, February 2011

.

"…this is a moment of urgency and opportunity, a chance to close the gap between the current state of educational achievement and the education system we need."

The Opportunity Equation: Carnegie Corporation of New York (2009)

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Collaboration is not a natural act…

Enlightened self-interest is!!

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Theory of Action I: Scaling Innovation Through Statewide STEM "Managed Networks"

Three key elements…

1. **Investing in key states** that can creatively apply their own intellectual and scientific, technical and corporate and financial to leverage and sustain multiple STEM approaches

2. Connecting these states and other partners through **active networking** designed to learn, capture and distribute innovation and change behavior

3. Funding national advocacy through a coalition of **outstanding champions** that range from corporate executives and political leaders to Nobel Laureates

What are THE DESIGN PRINCIPLES for the National STEM Mobilization?

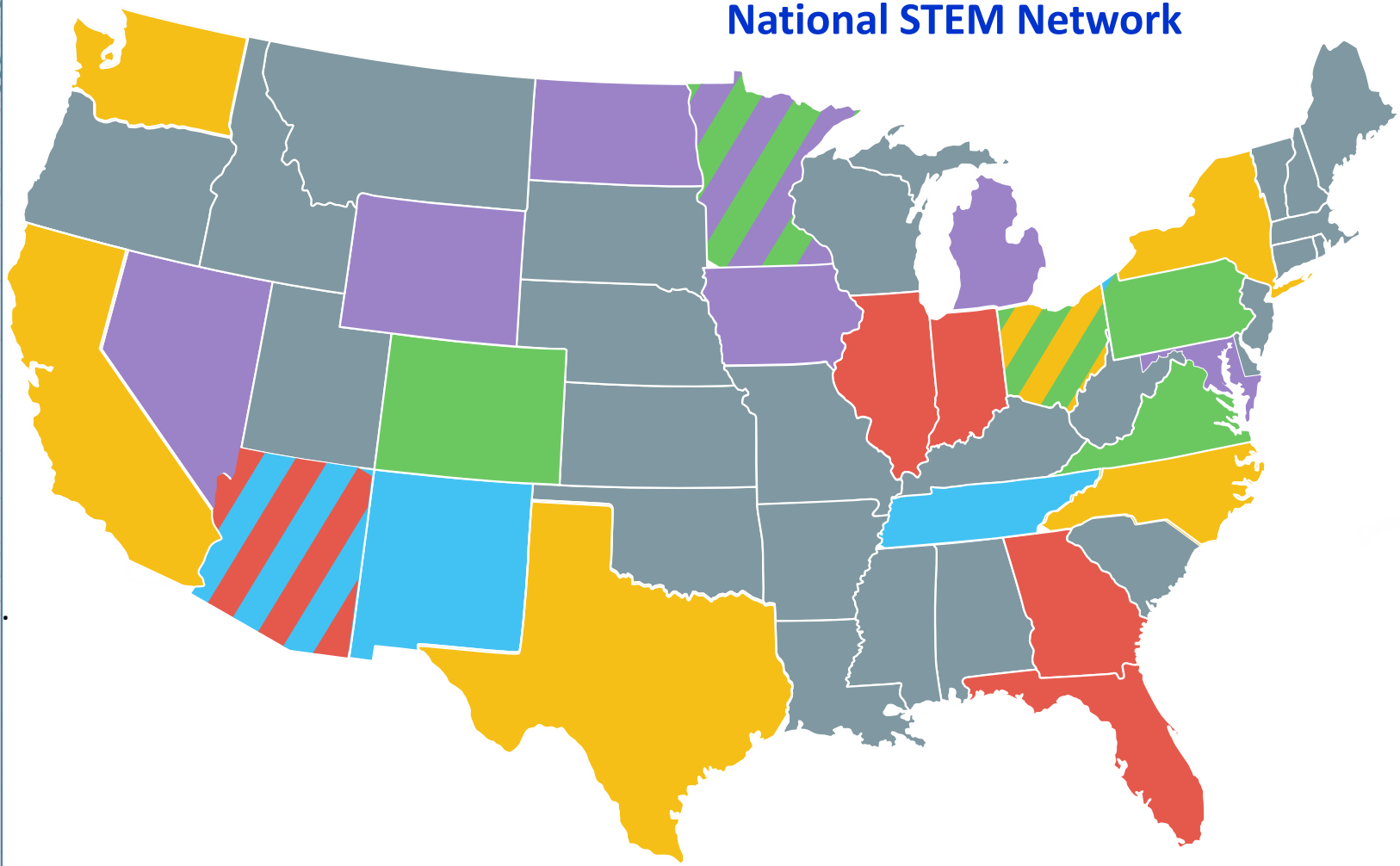
- An evident focus on STEM content and themes, **where students take at least four years of math and four years of science including pre-engineering**

- An explicit **set of core STEM skills, processes, language, critical thinking, design and problem solving that is integrated and reinforced across grades and disciplines**

- An evident culture that **honors STEM and inspires and helps students to pursue it while expressly integrating STEM with humanities and the arts**

- A **formal relationship with local STEM companies, institutions and universities** that provide both students and faculty deliberate STEM projects and internships; where they engage with real mathematics, science and engineering

National STEM Network



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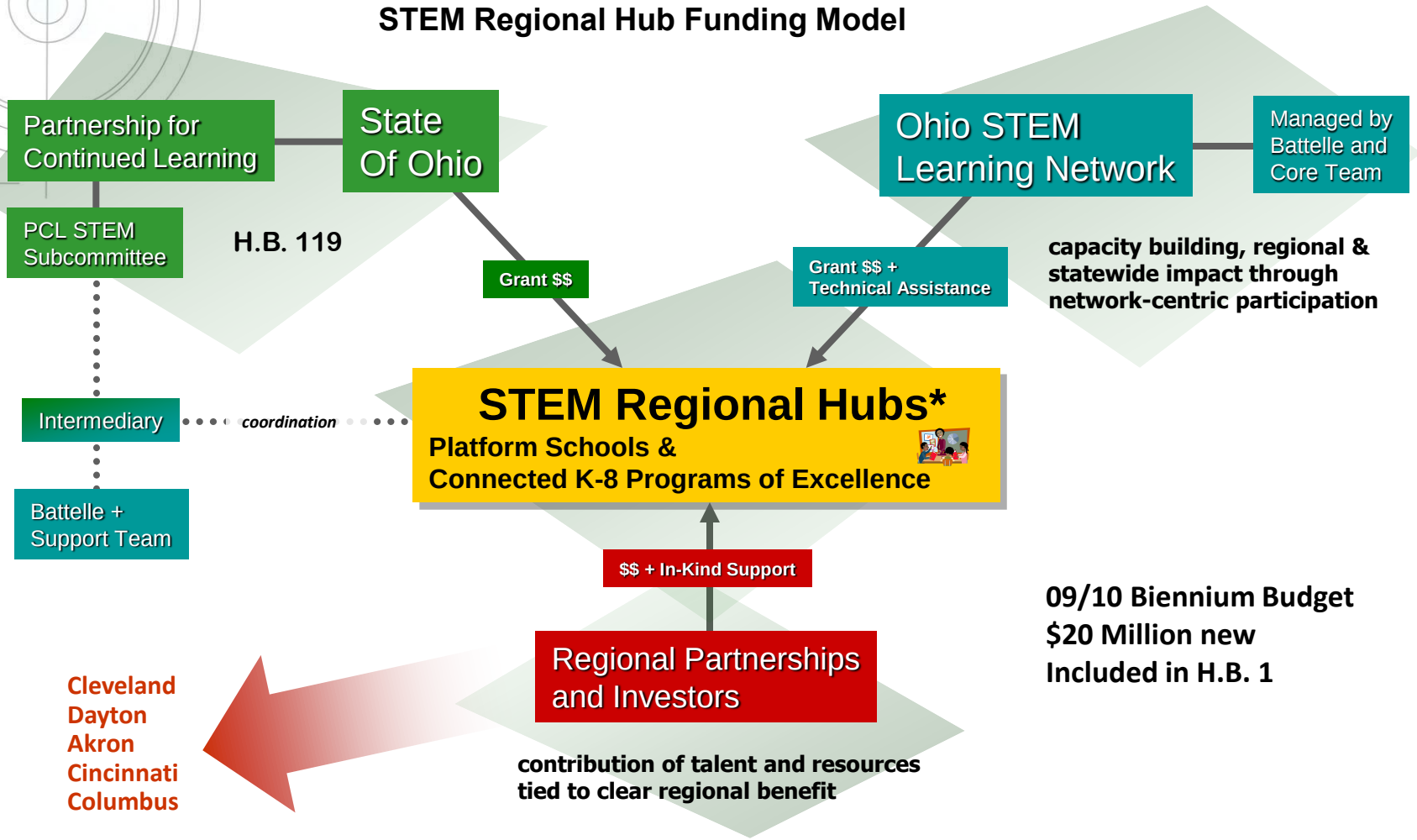
Ohio STEM Learning Network (OSLN) **Alignment of State, Private and Local Design Principles and Investments**

STEM Regional Hub Funding Model



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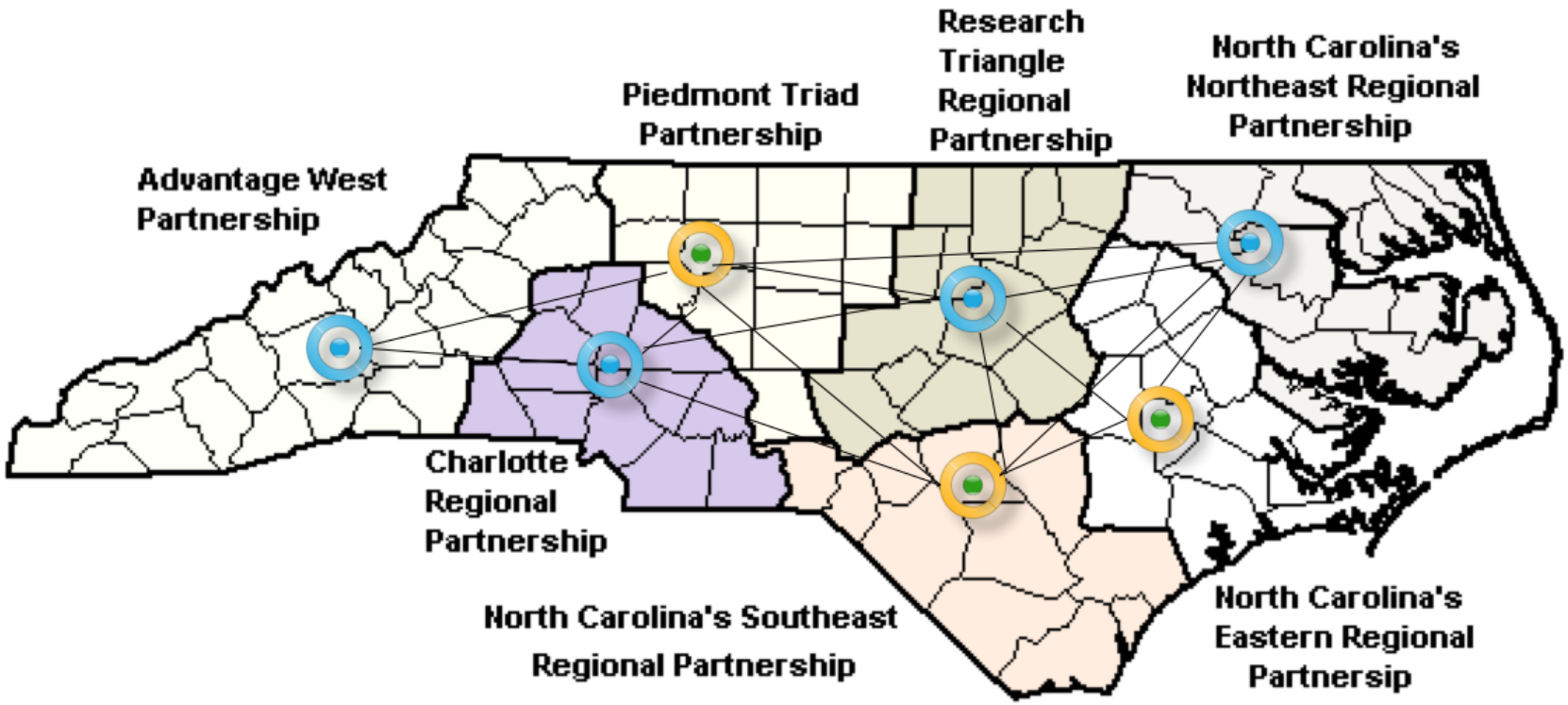
Building a Network of STEM Communities



Ready to Launch
3 STEM Communities engaged in 2009

Emerging/Incubating Communities
Future STEM Communities being identified

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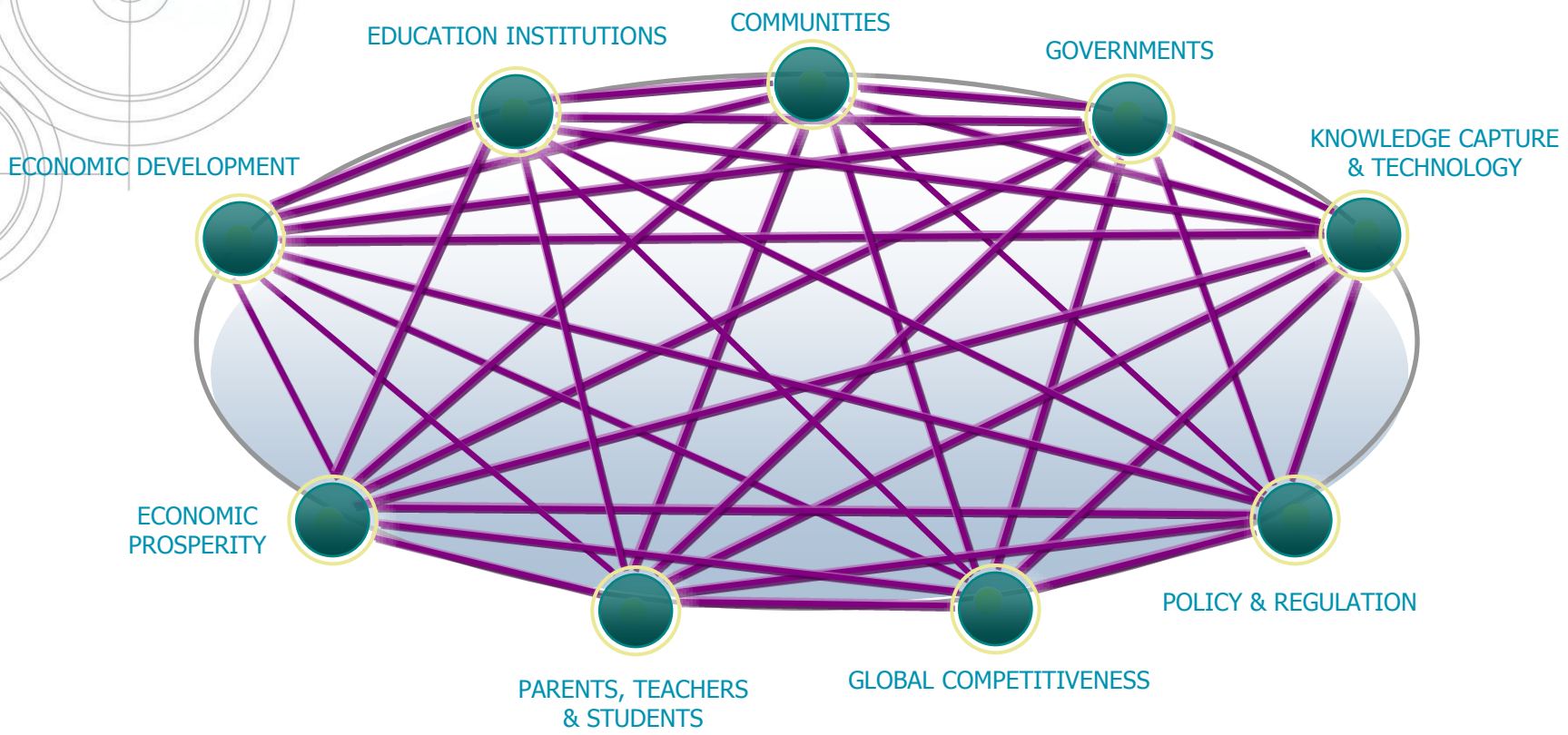
North Carolina STEM Community Collaborative—NC STEM… Our Challenge is Ours, Collectively



By connecting communities to the state of the art programs, standards and assessments, curriculum/content, professional development, and expertise, the entire network benefits.

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Empire State STEM Learning Network

Network design derived from progressive dialogue: A state-wide system of multi-dimensional, public/private partnerships to manage and execute strategic roadmap

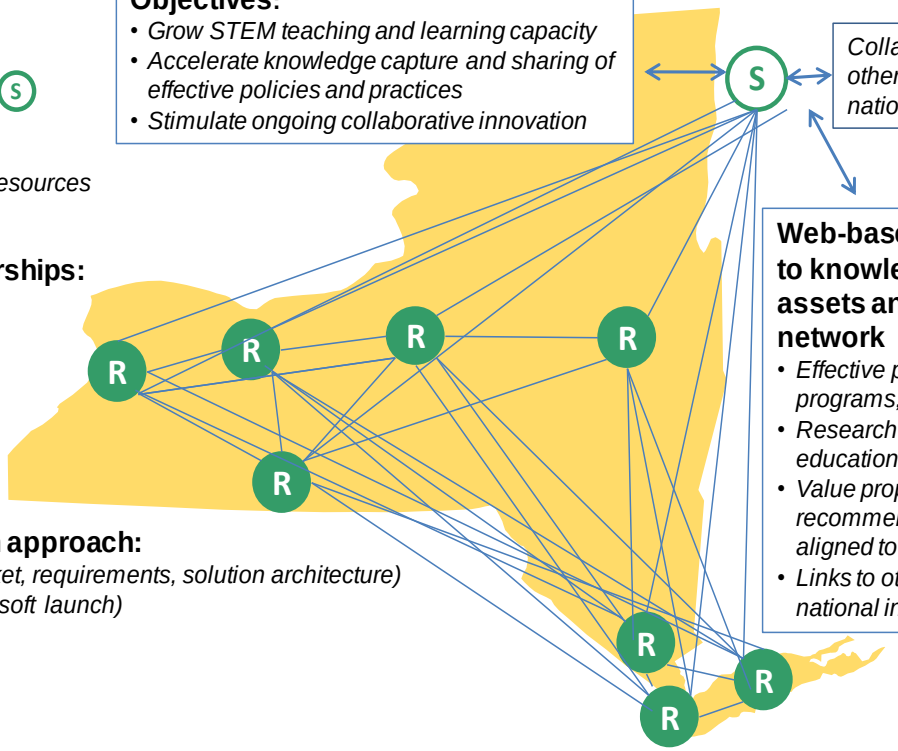
Multi-dimensional:
- *State-wide project office* (S)
- *Regional hubs* (R)
- *Local innovation teams*
- *Connections to national resources*

Public/private partnerships:
- *Business*
- *Education (PK-20+)*
- *Parents*
- *NGOs**
- *Government*

Agile systems design approach:
- *Concept (define the market, requirements, solution architecture)*
- *Prototype (develop beta, soft launch)*
- *Adapt (refine)*
- *Implementation (scale)*

*Non-government organizations

Objectives:
- *Grow STEM teaching and learning capacity*
- *Accelerate knowledge capture and sharing of effective policies and practices*
- *Stimulate ongoing collaborative innovation*



Collaboration with other state and national leaders

Web-based access to knowledge assets and the network
- *Effective policies, programs, processes*
- *Research on STEM education*
- *Value proposition and recommended actions aligned to constituency*
- *Links to other state and national initiatives*

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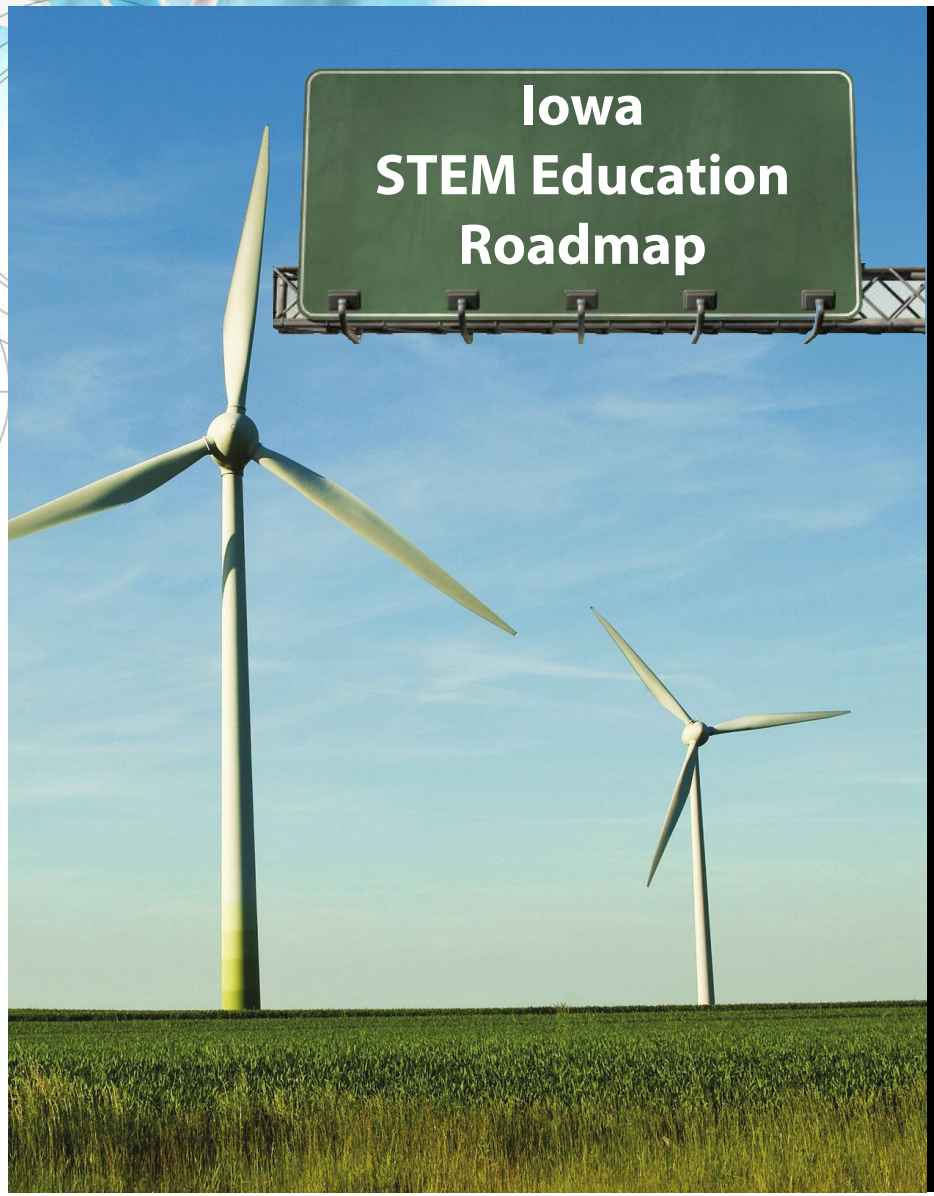

A Strategic Plan for Science, Technology, Engineering and Mathematics (STEM) Education

2011

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POWERED BY NATIONAL INSTRUMENTS™

State Farm

Chevron

Inhuman Energy™

4-H STEM
Science, Technology, Engineering + Math
WISCONSIN

Columbus City Schools
Baltimore County Public Schools
Oakland Unified School District
Chattanooga Public Schools
Stark County Schools
Chester County Schools
…and many more!!!

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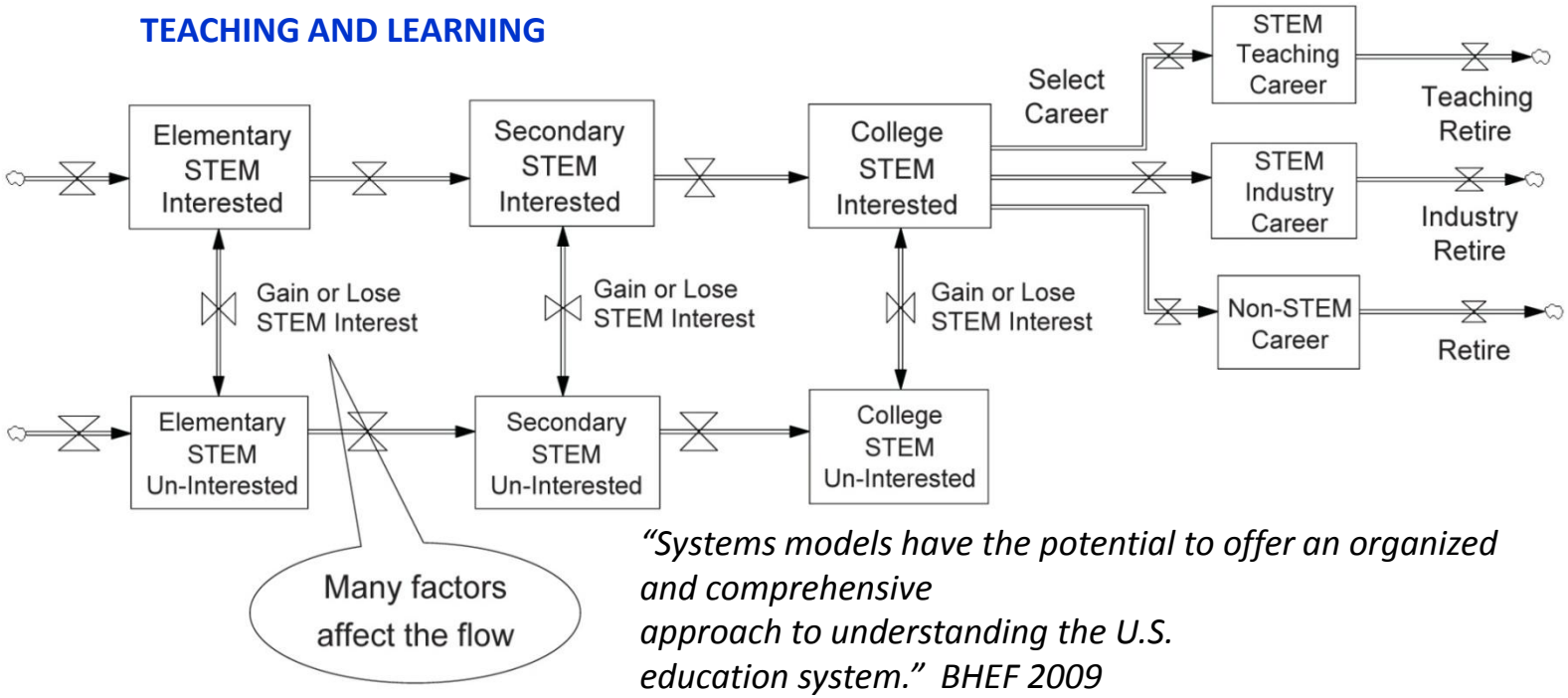
CONNECT a MILLION MINDS™
AN INITIATIVE OF TIME WARNER CABLE

Theory of Action II: SCALING AN EXPANDED ROLE FOR BUSINESS, INDUSTRY, HIGHER EDUCATION INCLUDING COMMUNITY COLLEGES AND TECHNICAL COLLEGES

RAYTHEON AND BHEF BRINGING SYSTEMS MODELING TO STEM TEACHING AND LEARNING



"Systems models have the potential to offer an organized and comprehensive approach to understanding the U.S. education system." BHEF 2009

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STEHM LEARN and EARN CHALLENGE

Maximize

working and learning student progressing through accelerated, competency-based, flexible pathways.

Double

the number of low-income young adults who, by age 26, earn a postsecondary credential with labor market value.

Learn and Earn Design Principles

"Credits and Dollars"

Strategic Alignment

- Value equally ***learning and working*** relationships that fundamentally change markets, business models and delivery channels.
- Form a single community of practice, PK-20 inclusive of community colleges, a continuous learning labor market, Career Technical Education and identified and driven by industry partners.
- Recognize and leverage 11th/12th grade as a gateway to postsecondary education and employment.
- Form nationally portable, industry-recognized credentials as part of education pathway.
- Synchronizes colleges and employers resulting in structured, clear and flexible credentialing pathways.

Rigor

- Provide academically rigorous, college-ready/ work-ready competency-based curricula that are both scalable and sustainable.
- Drive scalable and sustainable innovation that simultaneously lower recruiting and training costs.
- Anchors in clearly defined learning competencies for acceleration and quality.

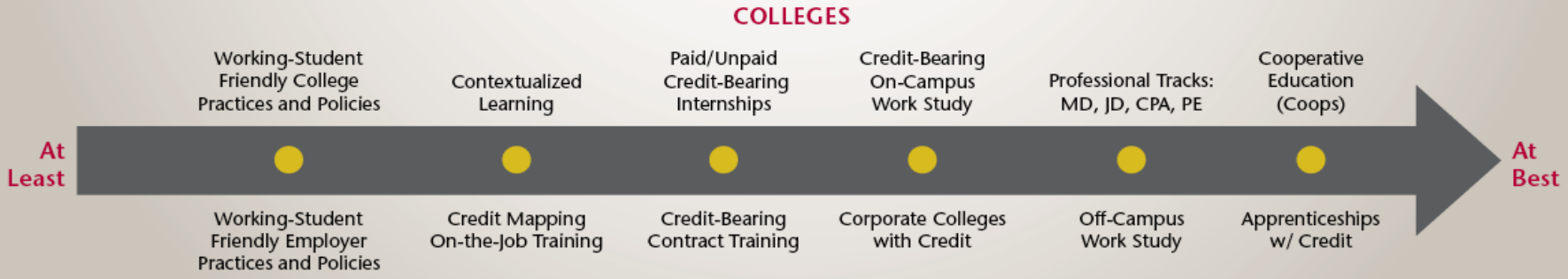
Relevant Work Experiences

- Ground all decisions in "real-time" industry driven-economic focused" data.
- Make STEHM literacy desirable and attainable for all students.
- Accelerates portable career rewards by including interim certificates/certifications that are recognized by employers with wage increases and/or promotions.
- Work experience is both "pay- and credit-worthy.

Financial & Non-Financial Support

- Coordinate resources from government and non-government agencies, education institutions and businesses to support Learn and Earn systems that overcome financial barriers that prevent college-qualified, low-income high school students from participating.

Learn & Earn Continuum Focus: Acceleration, Competency-based, & Flexibility



Funded by the Bill & Melinda Gates Foundation

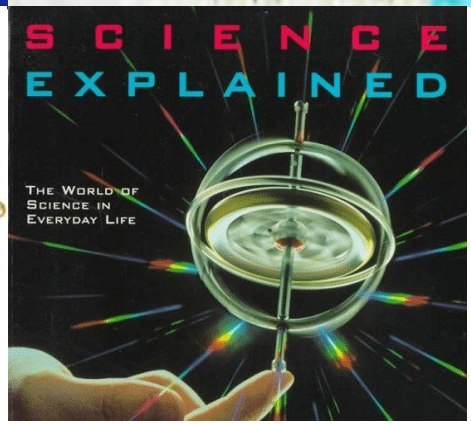
Theory of Action III: **Scaling Innovation Through Reform of Public Education…the Creation of STEM Schools**

"incubating innovative STEM instruction to scale to all schools so that STEM education is for ALL students…"

STEM SCHOOLS: CHANGING THE DNA OF STEM EDUCATION!

Technology

Academia/Industry



Single Community

Science Centers/Museums

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USA STEM Schools	FEATURES: Project-based Learning & Transdisciplinary Curriculum
Science Leadership Academy *(TFI)*	• Mastery/Proficiency Student-based Assessments • Rubric based on (design, knowledge, application) • Formative and summative • Digital Portfolio • PSSA / SAT (for college admission)
High Tech High *(San Diego)*	• Student-based Self-Assessments • "Exhibition:" Culminating Presentations of Learning • Journals, self-reflections • Rubrics +Process analysis sheets • Deadline completion check-offs • ACT (for college admission)
MC_2STEM High School *(G. E. Global)*	• Digital Portfolio • Mastery/Proficiency Based Student Assessments • Capstone Project Rubrics • Capstone "Exhibition" • SAT and ACT (for college admission)
IMSA *(Fermi Lab)*	• Digital Portfolio • Mastery/Proficiency • SAT and ACT (for college admission)
LEAP Charter Academy	• Mastery/Proficiency Student-based Assessments

MC² STEM HIGH SCHOOL

CLEVELAND METROPOLITAN SCHOOL DISTRICT

We are here this week…

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MC² STEM HIGH SCHOOL

CLEVELAND METROPOLITAN SCHOOL DISTRICT

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THE ART AND SCIENCE OF TEACHING STEM EDUCATION AND IN A STEM SCHOOL

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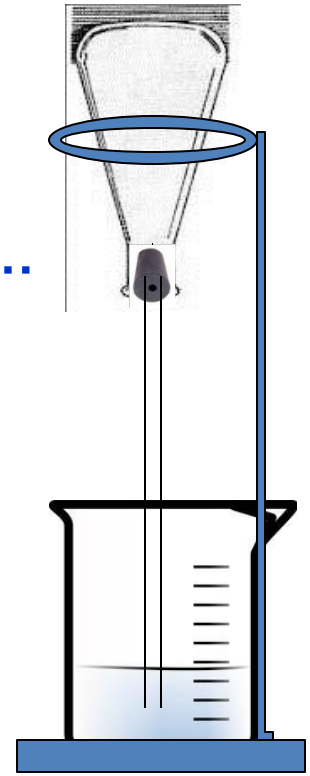
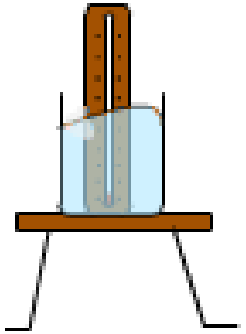
PROTOCOLS?

"I'll be happy to give you innovative thinking. What are the guidelines?"

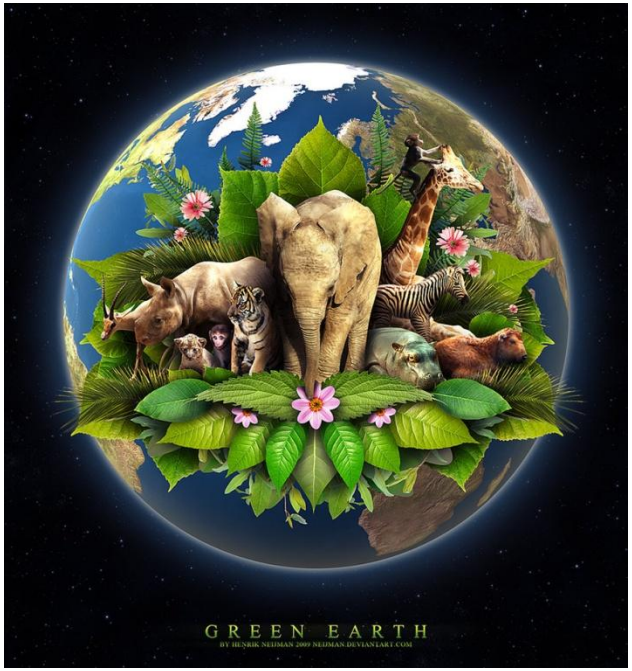
INGENGUITY AND CREATIVITY

No Black Boxes…

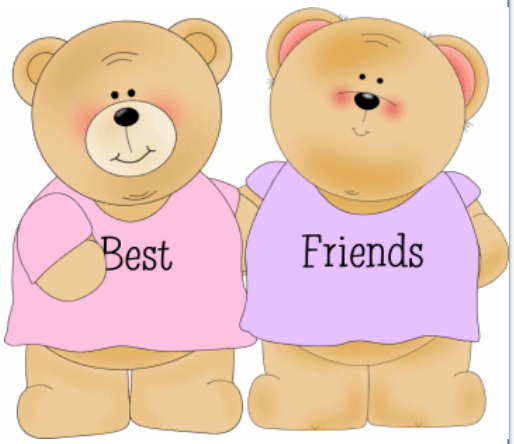




Issues that students care about as a driver of STEM Education….



HEALTHY FAMILIES
MEDI-CAL FOR CHILDREN



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Transdisciplinary Project-Based Learning…STEM in Action

MIT Fab Lab in Cleveland…*Imagine to Make*™

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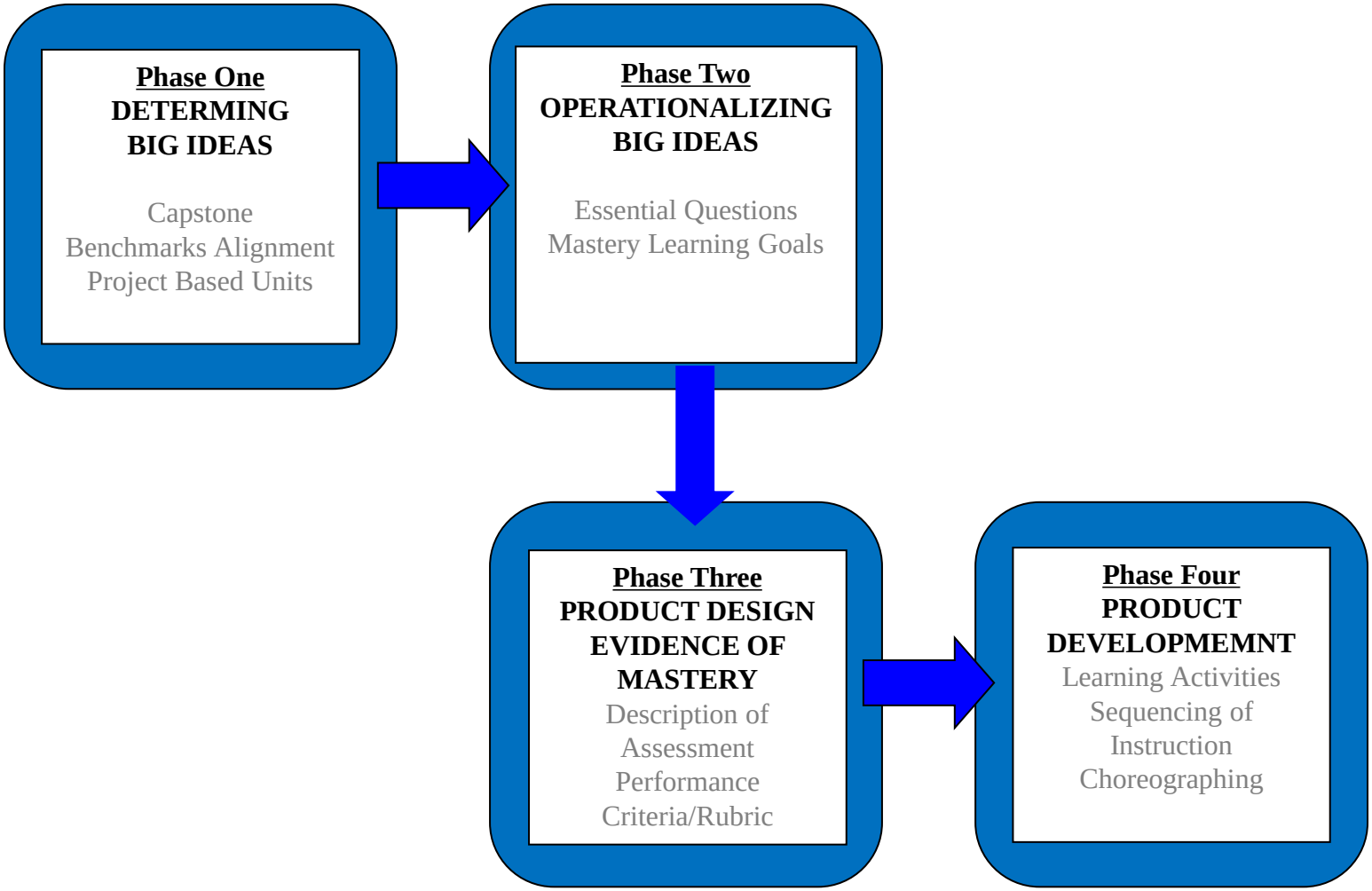
Teacher as Designer: *Systems Engineering* driving STEM



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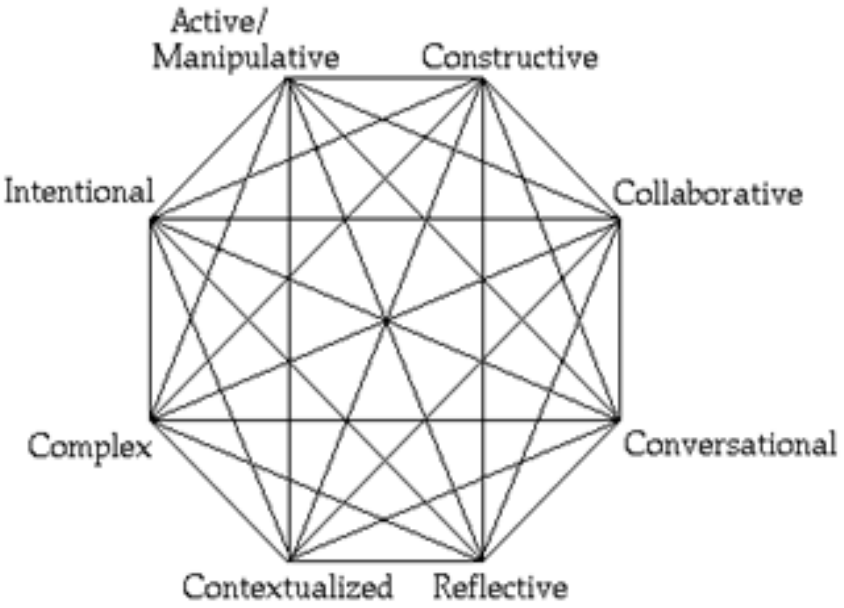
Teacher as Cognitive Scientist:
Assessment for Mastery and Proficiency driving STEM

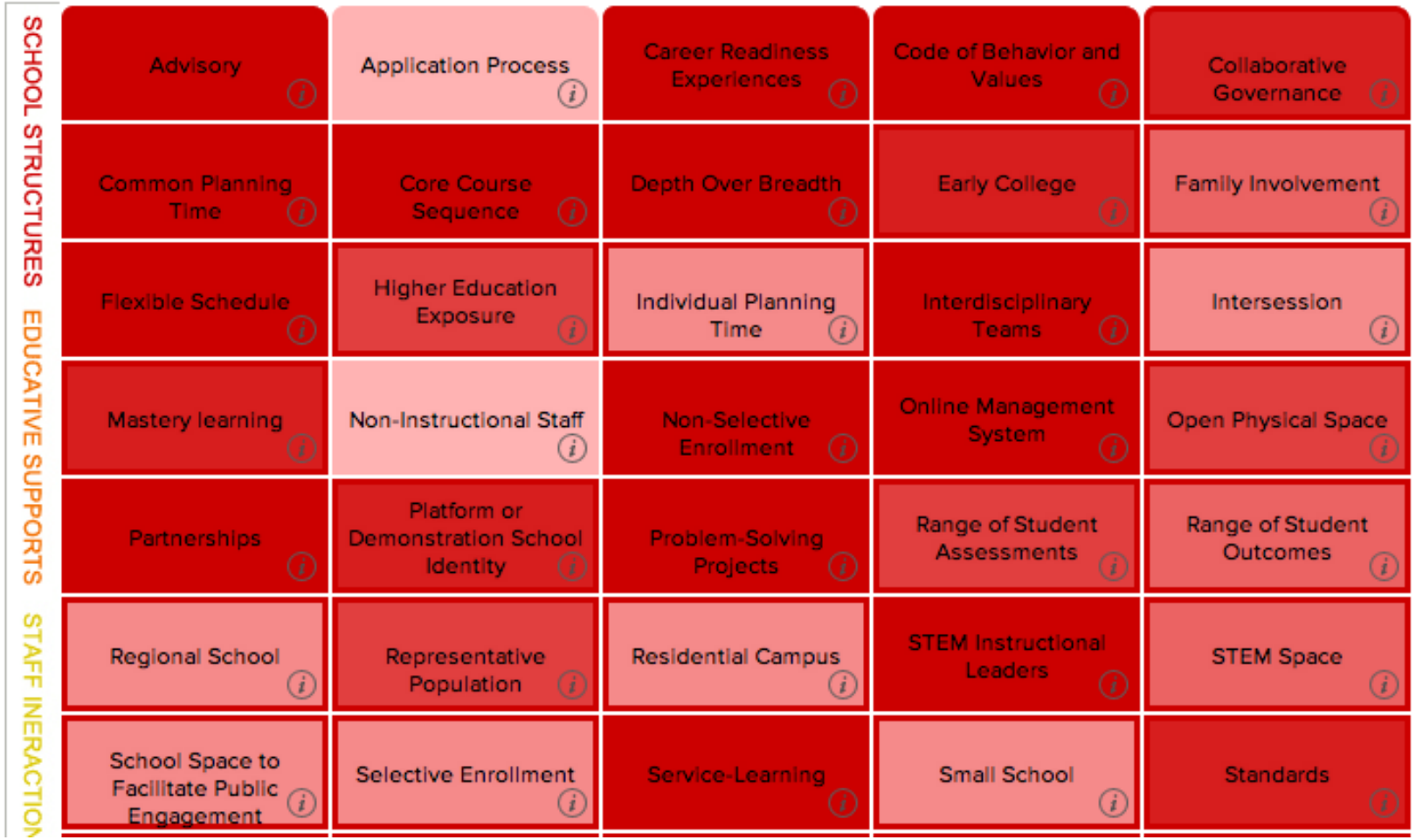
Learning STEM is….



WHAT DO SUCCESSFUL STEM SCHOOLS LOOK LIKE? HOW DO WE KNOW?

STEM SCHOOL ATTRIBUTES: THE RESEARCH PERSPECTIVE

NSF REESE GRANT UNIVERSITY OF CHICAGO, 2010



STEM School Attributes and Elements

Attributes & Elements of STEM Schools	Readiness Survey and Indicators	Not Demonstrated	Emerging	Proficient
STEM Literacy for all students - strategies that engage the mind and prepare students to be designers, innovators, and critical thinkers to solve complex problems				
Culture of trust, inquiry, creativity and possibility				
Policies and practices that support equity and access for all students, including under-represented populations				
Student Support Systems that meet the academic needs of youth (especially under-represented populations), e.g., direct experiences with real STEM professionals through summer bridge programs taught by STEM teachers, and field trips facilitated by community youth development organizations				

Design Blueprints: Texas STEM Initiative Blueprint and Rubric

Texas Science, Technology Engineering and Mathematics

T-STEM Academies Design Blueprint

The T-STEM Academies Design Blueprint is intended to serve as a road map for benchmarks, program requirements, and indicators to facilitate individual STEM Academy growth along the Blueprint Rubric Continuum of Developing, Implementing, Mature, and Role Model. Each Academy may differ in their areas of strength as evidenced by their self-evaluation and resulting Annual Action Plan; however, the following is a list of core program requirements that are non-negotiable.

Idaho's STEM Goals: Design Principles for Advancing the Idaho STEM Agenda

GOAL ONE

Develop and implement curriculum, programs, and policies to improve K-12 student content, knowledge, academic performance, and interest in STEM, thus creating the talent needed for a vibrant and growing economy.

GOAL TWO

Increase quantity, quality and diversity of teachers who are comfortable, prepared and able to incorporate and integrate STEM in their curriculum and instruction

GOAL THREE

Increase awareness of STEM education and its importance to the future of Idaho's economy, communities, organizations, schools and families.

GOAL FOUR

Develop, leverage and expand partnerships in STEM education by inspiring and leading collaboration among education, business, community and government.

GOAL FIVE

Promote access to STEM education opportunities to increase the diversity and success of students and employees entering STEM fields through the facilitation of effective recruitment, retention, and advancement strategies.

GOAL SIX

Develop a STEM talent base that is prepared to meet the demands of a globally competitive economy and is informed by and collaborates with IGEM

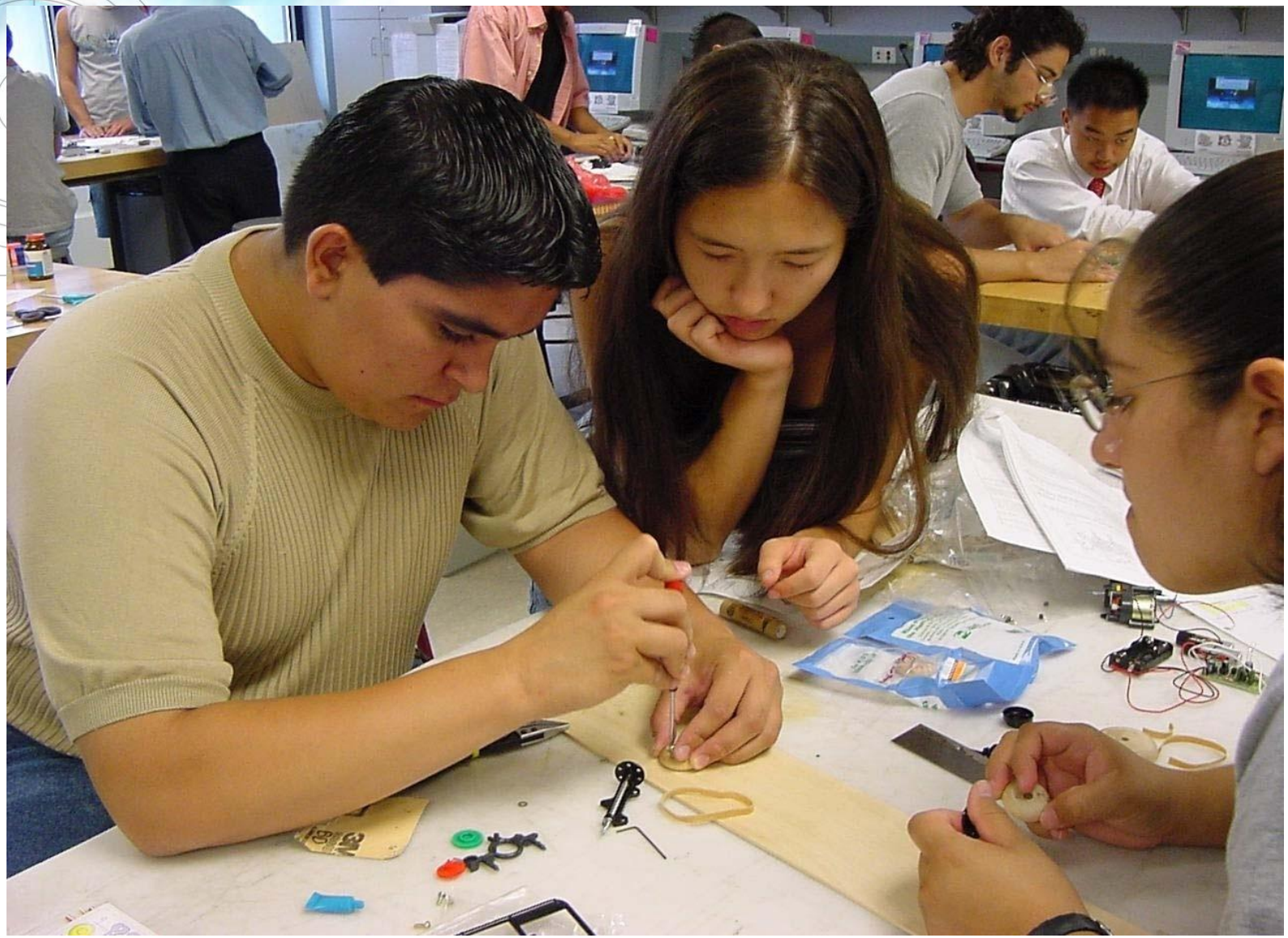
Idaho's STEM PARTNERS

i-STEM Education

idaho Science Technology Engineering Mathematics

EPSCoR

Idaho's STEM FUTURE!!



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